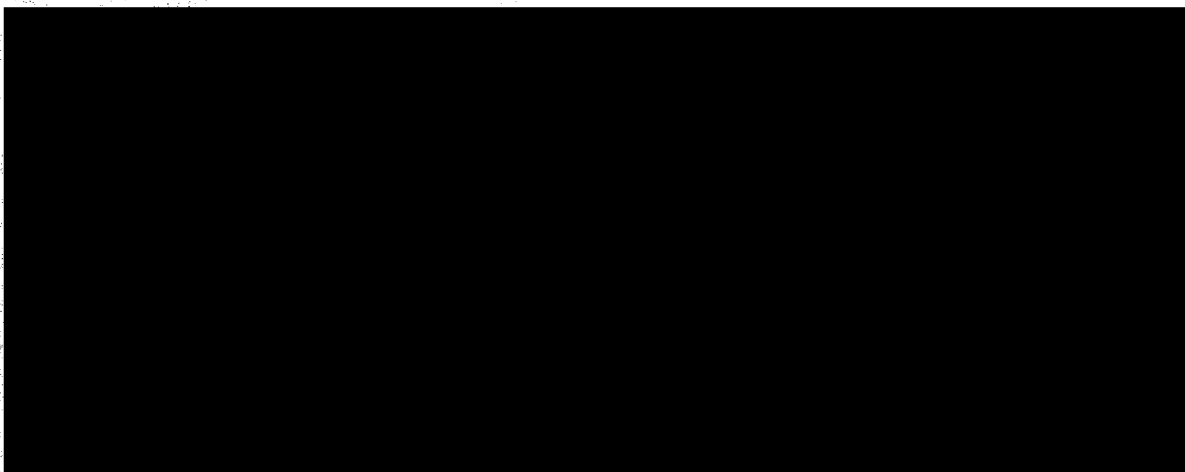



Declass Review by NIMA/DOD

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STATOTHR

 No. 7506

DIRECT IMAGE VIEWER  
Second Quarterly Report

10/13/64 - 1/13/65

Project 7506

  
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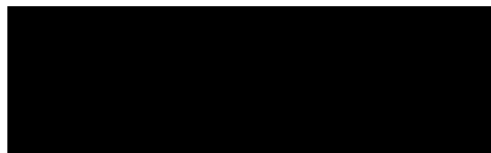


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I. PROGRESS SUMMARY

The progress is summarized in the following list:

- A. The design of the viewer is complete.
- B. Detailing of all mechanical parts will be completed by about 31 January.
- C. The light source was changed from an 800 - 1000 watt Xenon arc to a 1500 watt projection bulb.
- D. Eighty per cent of all mechanical parts are fabricated.
- E. The x-y translation mechanism has been assembled and tested.
- F. [REDACTED] has completed the first try under Phase II. A test report will be presented at the next meeting, which will be held on 29 January 1965.
- G. [REDACTED] is at work on fabrication of the optics. Their schedule has slipped two months.

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## II. ADMINISTRATIVE DETAILS

### A. Schedule

The schedule submitted in the first three months' report has lengthened due to the late delivery of optics from

STATOTHR [REDACTED] Their required delivery date was 15 January 1965. This has been extended to the week of 22 March for completed delivery of all optical elements, some of which should be delivered by mid-February. [REDACTED] was more than three months late in delivering the optical specifications; this placed an added scheduling burden on [REDACTED] to maintain the overall design and detailing schedule. STATOTHR

STATOTHR In order to deliver the viewer as soon as possible, [REDACTED] [REDACTED] will assemble and check the electrical-mechanical portions of the viewer without the optics installed. When the optics arrive a minimum of time will then be required to align and STATOTHR STATOTHR optically test the instrument. A new schedule based on [REDACTED] [REDACTED] delivery schedule and the receipt of a grating from the customer by early April is shown in Figure 1.

### B. Change of Scope Submission

During this quarter the change of scope for the Xenon water cooled arc lamp was withdrawn. The reasons for this withdrawal are given in Section IIIA.1. The change of scope covering the X-Y translation mechanism is still under consideration by the customer with a decision soon to be forthcoming. Due to the lateness of this submission and subsequent decision, [REDACTED] has proceeded with incorporating this change into the viewer design.

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Figure 1.

TASK	Jan.	Feb.	Mar.	Apr.	May	June	July
Optical Fabrication - Diffraction Limited							
First 2 x 2 Grating -							
Meeting at - Review Grating							
Second Try on 2 x 2 Grating -							
Evaluate Grating							
Fabrication of 10 x 10 After Second Try							
Install 10 x 10 from							
Fabrication and Assembly - Viewer (no optics)							
Electro-Mechanical Checkout							
Install Optics and Align							
Install Grating (customer's)							
Test System							
Deliver							
Prepare Manual							
Second Set Optics -							

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PLANNED SCHEDULE  
for  
DIRECT IMAGE VIEWER

Based on: Schedule from

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### III. TECHNICAL DISCUSSION

#### A. Progress

##### 1. Optics

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[REDACTED] has been working on the various optical components. Most of the work to date has been on the modification of the two objective lenses for the insertion of the square apertures. The design and detailing of the condenser systems has also been in progress. Design of the field lens is reported to be complete but fabrication has not yet begun. The field lens will consist of three elements, with one element located on the objective lens side of the grating and the other two between the grating and the observer. The optical layout depicted in Figure 2 indicates an optical path of approximately 74 inches, which results in a total viewer length of 80 inches.

The requirements for the condenser optics as discussed in the first quarter report have been modified since the ground glass may no longer be required. This is because of the more uniform brightness of the tungsten lamp. It has closely packed filaments and with the aid of a reflector should provide a fairly even area of light for the condenser optics to collect.

The other area discussed in the previous report was the requirement for a greater amount of light flux than initially anticipated. This was to be achieved with a Xenon arc lamp. This is a relatively costly device for many reasons, one of these being an auxiliary optical device to control the intensity, since the arc changes size as the current is reduced to lower the intensity.

Consideration was given to other light sources, particularly the standard projection lamp which had been previously rejected because of its much lower Kelvin temperature. Calculations were made which indicated that the light flux in the portion of the spectrum to be used was equivalent to the 800 watt Xenon lamp.

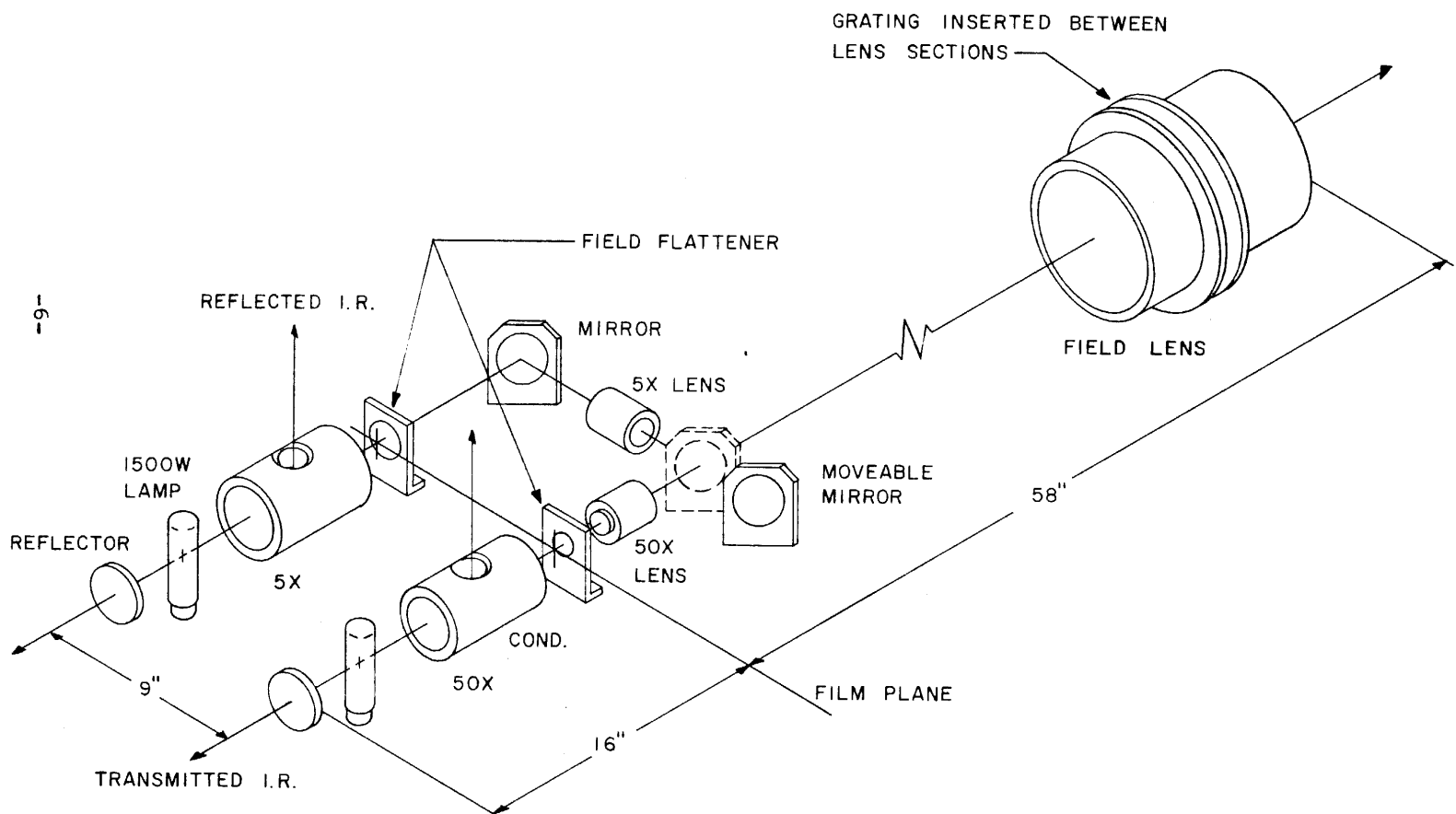
A 1500 watt projection lamp was obtained and a small test program set up. Permission was obtained from a Xenon lamp manufacturer to test his lamps at his facility. A filter was obtained which transmitted the band from 495 - 525 mμ. A milli-ammeter and photo resistor with a peak sensitivity at 510 mμ was used in conjunction with a simple optical setup to compare the luminous intensity and luminance of the 1500 watt projection lamp to an 800 watt Xenon short arc and a 1700 watt 2 inch long tubular Xenon arc. The results indicated that the 1500 watt projection had almost twice the luminous intensity of the 800 watt Xenon short arc, and slightly higher intensity than the 1700 Xenon lamp. The luminance of the 800 watt was greater due to its much smaller area. This was of no significance, because either source size could be imaged through the system. The large advantage with the projection lamp is that it can be easily controlled in luminous intensity by varying the voltage. The lamp life is much less than that obtained with the Xenon lamp, but considerably less expensive. The viewer has been designed for easy bulb replacement.

The expected life of the projection bulb is 50 hours whereas the Xenon lamp would be around 1000 hours. Comparable lamp costs would be \$14.00 for the projection bulb and \$200.00 for the Xenon lamp. These were of minor consideration, the main factor being the added initial viewer costs of around \$8,000.00 for the Xenon lamp.

A continuous spectrum source such as the projection bulb or Xenon lamp, while not efficient at the wavelengths used, does allow testing with various filters and different wavelength bands.

An optical layout of the viewer is shown in Figure 2. Examination of the layout gives some idea of the magnitude of optical components contained in the viewer.

OPTICAL PLAN  
DIRECT IMAGE VIEWER



## 2. Diffraction Grating

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During these past three months, [REDACTED] has conducted their first try at a 2 x 2 grating. The grating and two replicas are made and tested. As of this writing a report is being prepared by [REDACTED] and will be presented at the next STATOTHR meeting held at [REDACTED] on the 29th of January.

## 3. Viewer

During the last three months considerable progress has been made on the viewer design and manufacture.

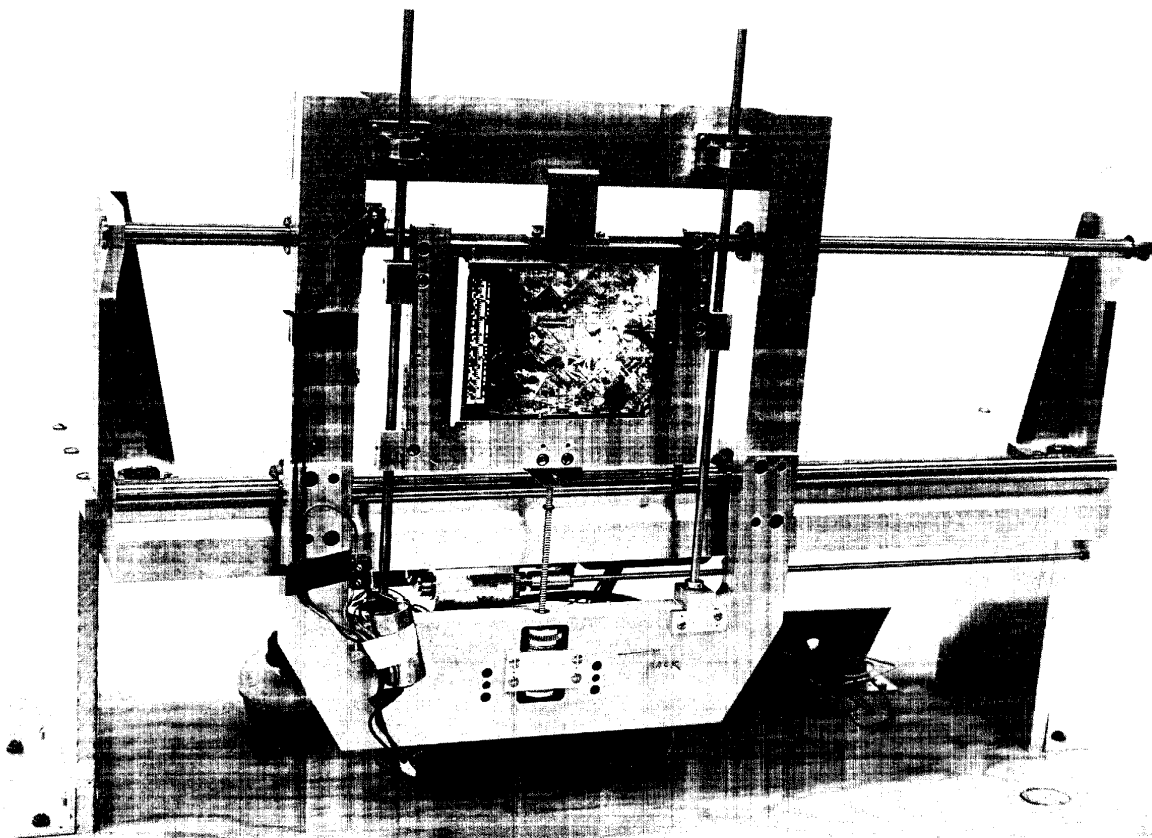
The x-y translation mechanism, which is a major mechanical design area, was designed at the end of the previous reporting period. During this period the mechanism was detailed, fabricated and tested. It will now be disassembled and black anodized, then reassembled and the appropriate parts pinned. The enclosed picture, Figure 3, shows the mechanism during testing.

The focusing mounts for the objective lenses and moving mirror assembly are fabricated. The focusing mounts are designed with consideration given to the differences in "depth of focus" of each of the lenses. Both are designed to provide smooth movements into the tenths of thousandths of inches. One full turn of the 50X focus knob will move the lens .002 inch, whereas the 5X lens will move about .006 inches per turn. This should allow the operator to easily and precisely adjust the focus of each lens. The lamp housings and blower assemblies are also fabricated. The air for cooling the lamps is provided by vane axial fans and is designed to flow past the bulb at 1500 ft/min. velocity. This air is exhausted from the rear panel of the viewer. Some light will also be transmitted through this exhaust duct. This light should not bother the operator at the other end of the machine.

The frame is designed and fabricated. Control panel fabrication is complete and will be assembled shortly. A coated

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X-Y Translation Mechanism (During Testing)



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glass window will be placed between the viewing bezel and the front of the field lens. This will seal the front of the viewer from dust and protect the large field lens.

We were able to design an attractive front control panel while still keeping the cost in line with the engineering prototype concept by the use of a simple casting. A photograph of the casting is shown in Figure 4.

The use of a standard projection bulb as discussed earlier eliminates the need for an auxiliary enclosure for the lamp power supply. All equipment will be contained within the viewer. At the rear of the viewer will be a fitting for attaching the vacuum hose, connection for 115V cps, 15 amp power, and a fuseholder.

An overall picture of the viewer configuration and appearance can be obtained by looking at the following two figures (5 and 6). Figure 5 is the top assembly drawing and 6 an artist's sketch of the completed unit. Aluminum jig plate has been used for the frame to provide a stable vibration free base for the optics. Bulb replacement and filter changes are performed by removal of the vented panel on top. Film chips are inserted through the small hatch on top. The large outer shell requires removal only if repairs are required. Then once the shell is removed the mechanism is quite accessible.

#### B. Trips

No trips were made during this quarter of work.

#### C. Work Planned for Next Period

##### 1. Optics

The fabrication of the optics is scheduled for delivery during the latter part of the next period.

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Front Panel Casting

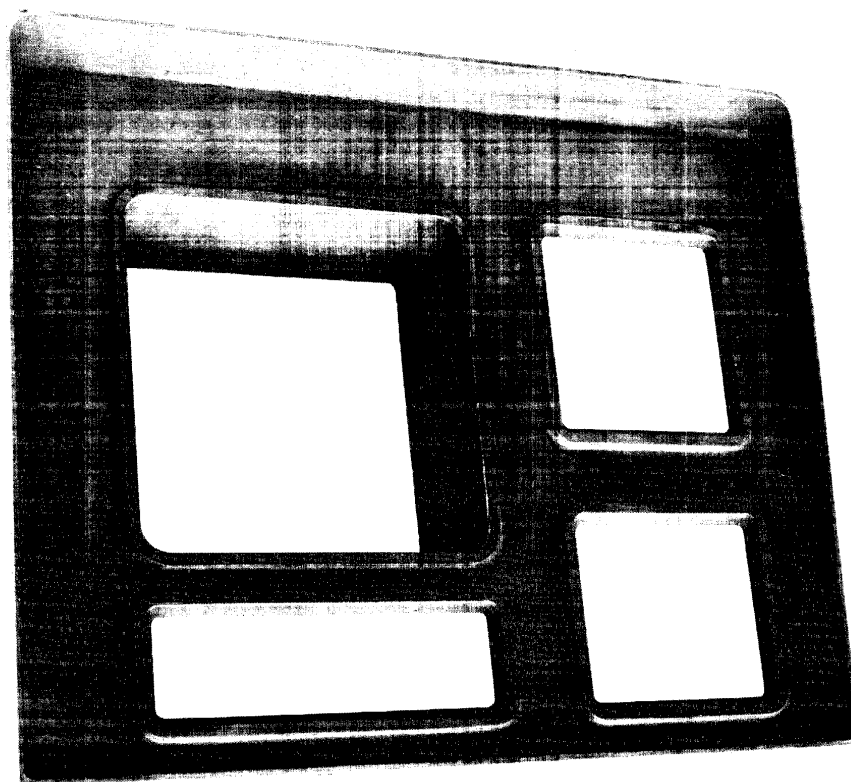


Figure 4.

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## 2. Diffraction Grating

The diffraction grating portion of the program will be evaluated at the meeting which will be held at [REDACTED] STATOTHR on the 29th of January. Since the customer is also manufacturing a grating and the relative merits of the two techniques must be evaluated, the future plans for this portion of the contract are explicitly known at this time. It is felt, though, that a second test try should be initiated.

## 3. Viewer

The viewer will be completed and will be undergoing acceptance testing. The viewer should be delivered just about the time of the next report.

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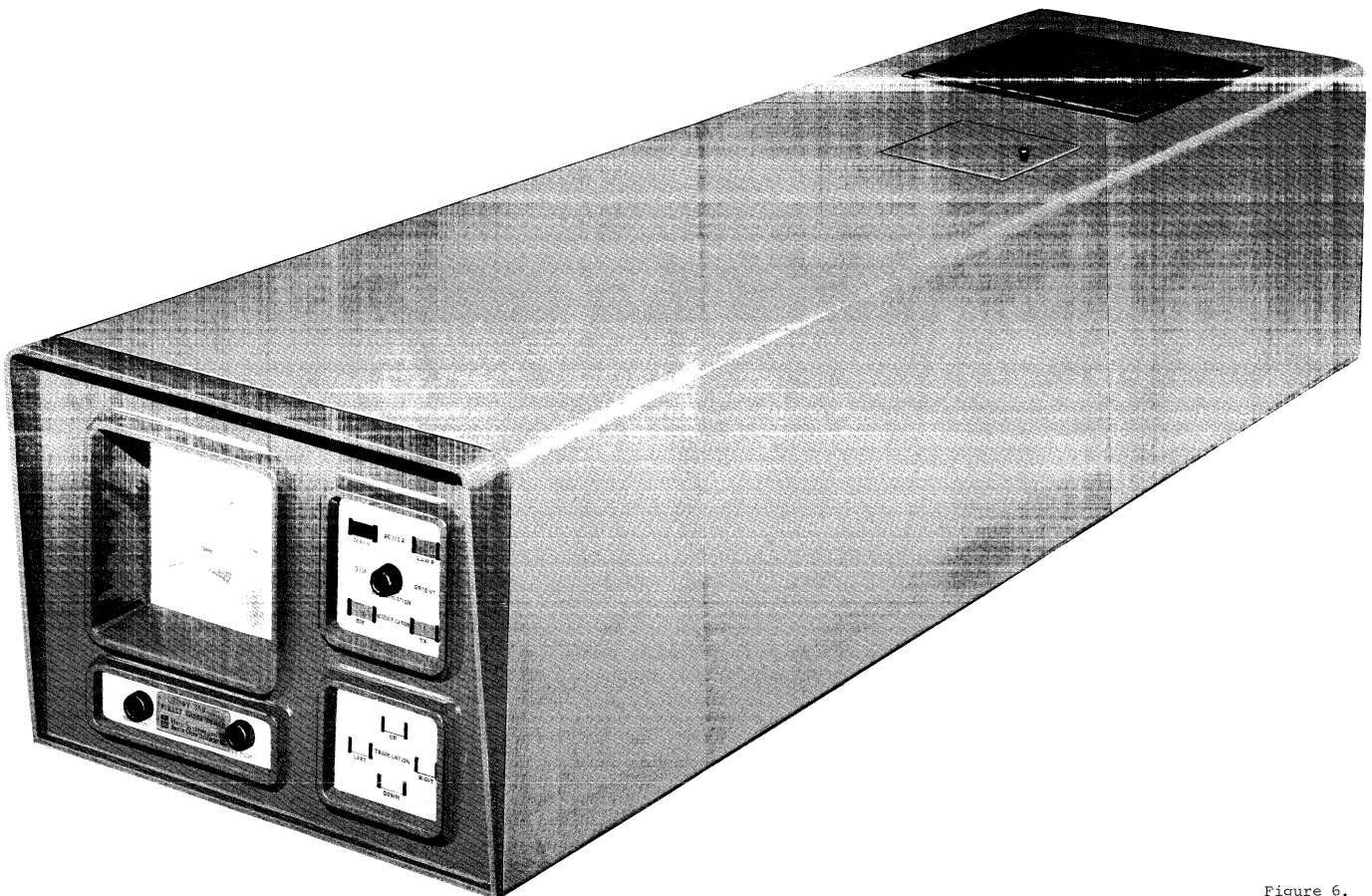


Figure 6.

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